

Summer 2008 Summary For Southwest Lower Michigan

By William Marino

The long range forecast we issued for this summer called for equal chances (EC) for above, below, or near normal temperatures and precipitation. As it turned out the summer of 2008 was near normal in temperature, yet it was the coolest summer since the summer of 2004. Precipitation was well above normal even though August was very dry. The summer normals are found in Table 1 below. What actually occurred at the sites listed in Table 1 is found in Table 2.

Table 1. Summer normals for selected locations in Southwest Michigan
NORMALS

	GRAND RAPIDS	MUSKEGON	LANSING
TEMPERATURE: (June – August)			
HIGH:	80.1°F	77.9°F	80.0°F
LOW:	58.4°F	57.6°F	56.6°F
MEAN:	69.3°F	67.8°F	68.3°F
Days >= 90°F:	9.5	2.2	9.2
PRECIPITATION: (Total for June – August)			
	11.01"	8.67"	9.74"

Table 2. The table below shows the actual climate data for the summer of 2008 for selected locations in Southwest Michigan.

Summer 2008 Data

	GRAND RAPIDS	MUSKEGON	LANSING
TEMPERATURE (AVE):			
June – August			
HIGH:	81.1°F	77.5°F	80.4°F
Departure from Normal	+1.0°F	-0.4°F	+0.4°F
LOW:	60.1°F	58.4°F	58.4°F
Departure from Normal	+1.7°F	+0.8°F	+1.8°F
MEAN:	70.6°F	67.9°F	69.4°F
Departure from Normal	+1.3°F	+0.1°F	+1.1°F
Days >= 90°F:	2	0	2
PRECIPITATION (Totals):			
June – August	12.13"	9.01"	8.79"
Departure from Normal	1.12"	0.34"	-0.95"

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To be considered normal, the mean area temperature has to be within nine tenths of a degree of the 1971 to 2000 mean (i.e., between 69.2 ° and 67.4°). Using those criteria, six of the last ten summers were warmer than normal, two were cooler than normal (2000 and 2004) and two were near normal (2008 and 2003).

Temperature Discussion:

The summer of 2008 was normal for temperature, yet still the coolest summer since 2004. In fact, for Southwest Lower Michigan it was the 44th coolest summer since records began in 1895. The area average was 68.2° F (based on 36 long term climate stations in this region), which is 0.1° below the normal summer area mean temperature of 68.3° (Fig. 1). Looking back on the past ten years, only 2000 and 2004 were colder than this summer was. Figure 2 shows that the area departure from normal goes along with the idea that the summer averaged close to normal (Fig. 1).

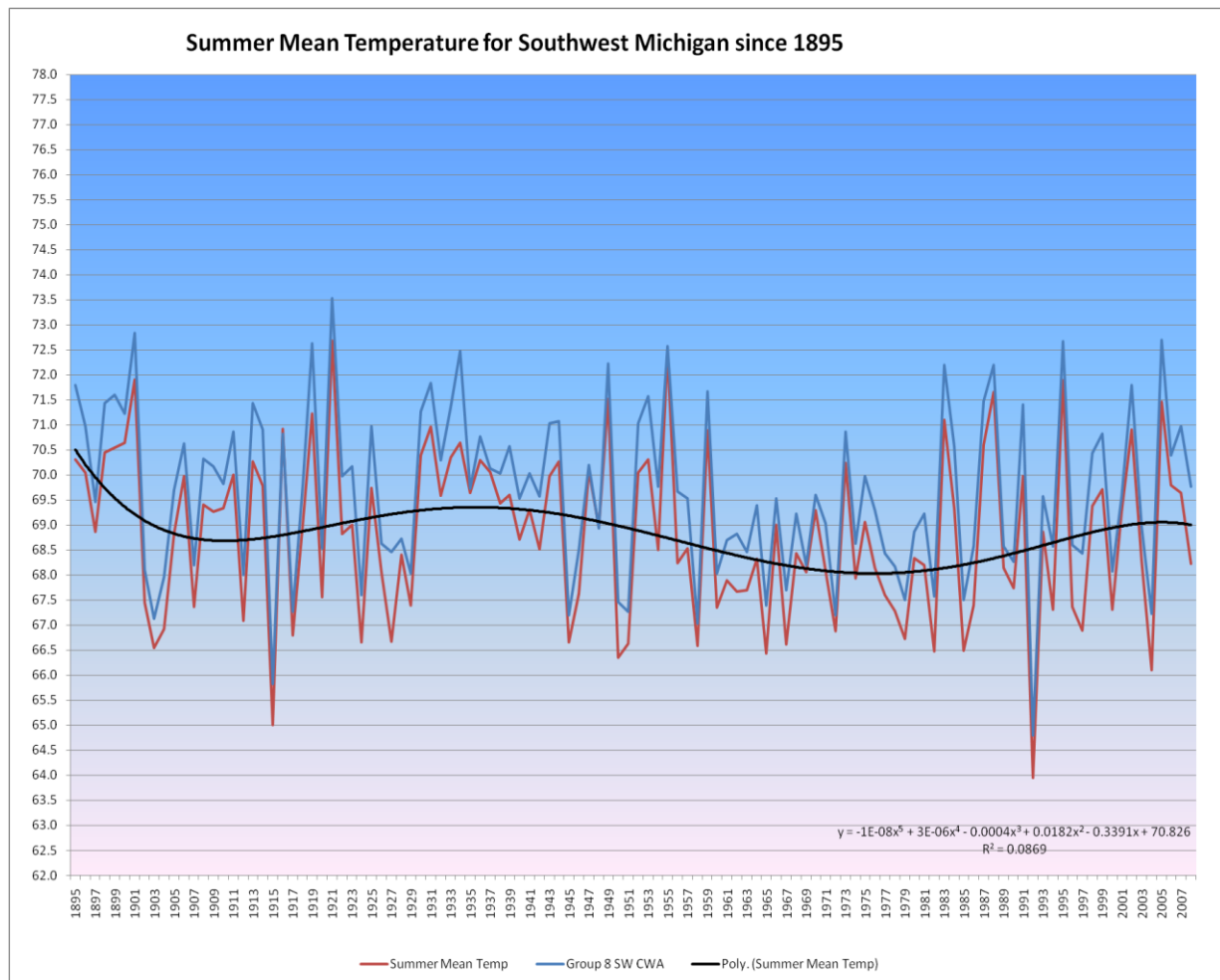


Fig. 1 Grand Rapids CWA area average summer temperatures since the summer of 1895 (the data for the 36 station average came from the Midwest Climate Center).

Looking at Fig. 1, 1971 to 2000 included some of the coolest summers since records began in 1895. It is for that reason that, although this past summer seemed cool, it was actually close to the 30 year normal calculated from 1971 to 2000. From 1960 through 1997, 63% of the summers were cooler than this summer.

Figure 2 show the coolest areas of southwest Michigan, relative to normal, were the central sections near the lake shore. Grand Haven averaged 66.3°, which was 1.3° below normal. Table 2 supports this as it shows Muskegon was 0.4° below normal, while Grand Rapids was 1.3° warmer than normal and Lansing was 0.4° warmer than normal. The area with the greatest positive departures from normal was just west of US-131. Battle Creek had a summer mean of 70.3°, which was 1.3 ° above normal.

Average Temperature Departure from Mean in Degrees F
June 1, 2008 to August 31, 2008

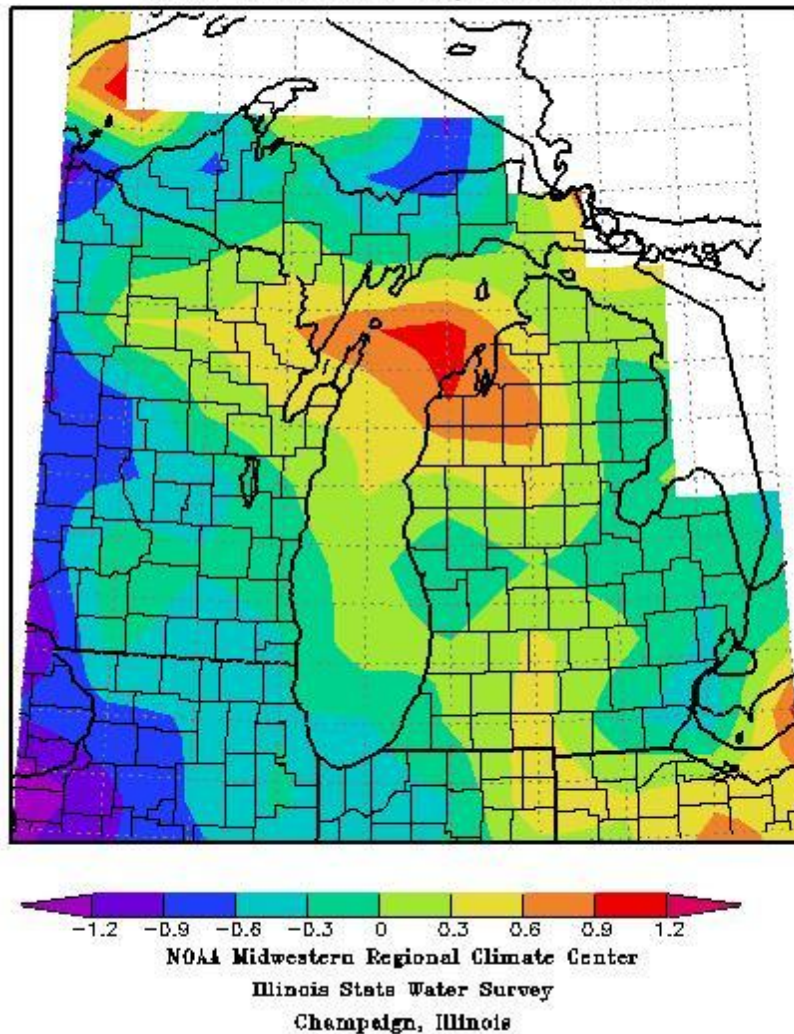


Figure 2 Departure from normal for the summer of 2008

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As seen in Figs. 3 through 5, most daily summer temperatures were near normal. July was the month closest to normal, while June, relative to normal, was the warmest. Typical of most summers, the warmest weeks of the summer of 2008 were the last two weeks of July and the first week of August. The coolest weeks of the summer of 2008 were the last week of June into the first week of July.

Also noteworthy is the relative lack of 90° days, especially compared to 2007. Table 2 shows Grand Rapids and Lansing got to 90° only twice this past summer. Table 1 shows 9.5 days are normal for Grand Rapids and 9 days are normal for Lansing. During the prior summer of 2007, the high temperature at Grand Rapids reached at least 90° nineteen times.

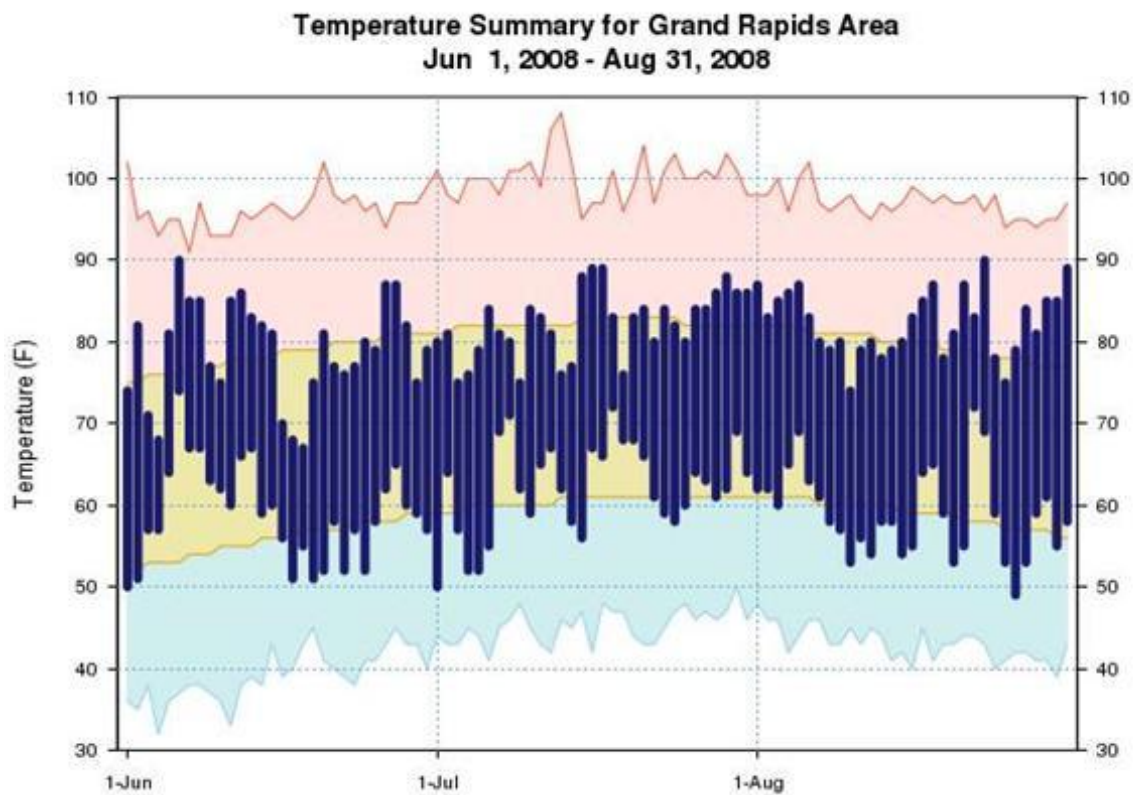


Fig. 3 Grand Rapids daily temperature for the summer of 2008. The observed daily maximum and minimum temperatures are connected by dark blue bars. The area between the normal maximum and minimum temperatures has tan shading. Red lines connect record high temperatures. Light blue lines connect the record low temperatures.

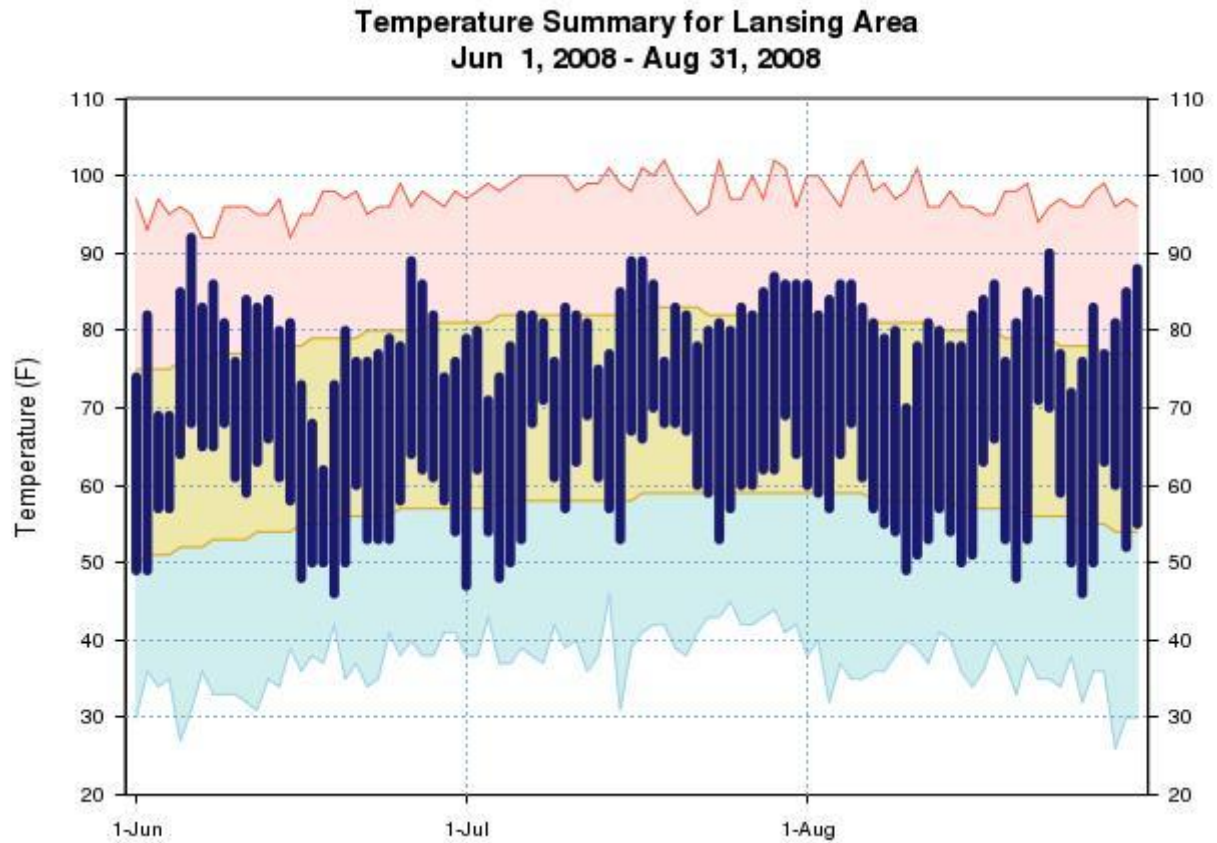


Fig. 4 As in Fig. 3 except for Lansing

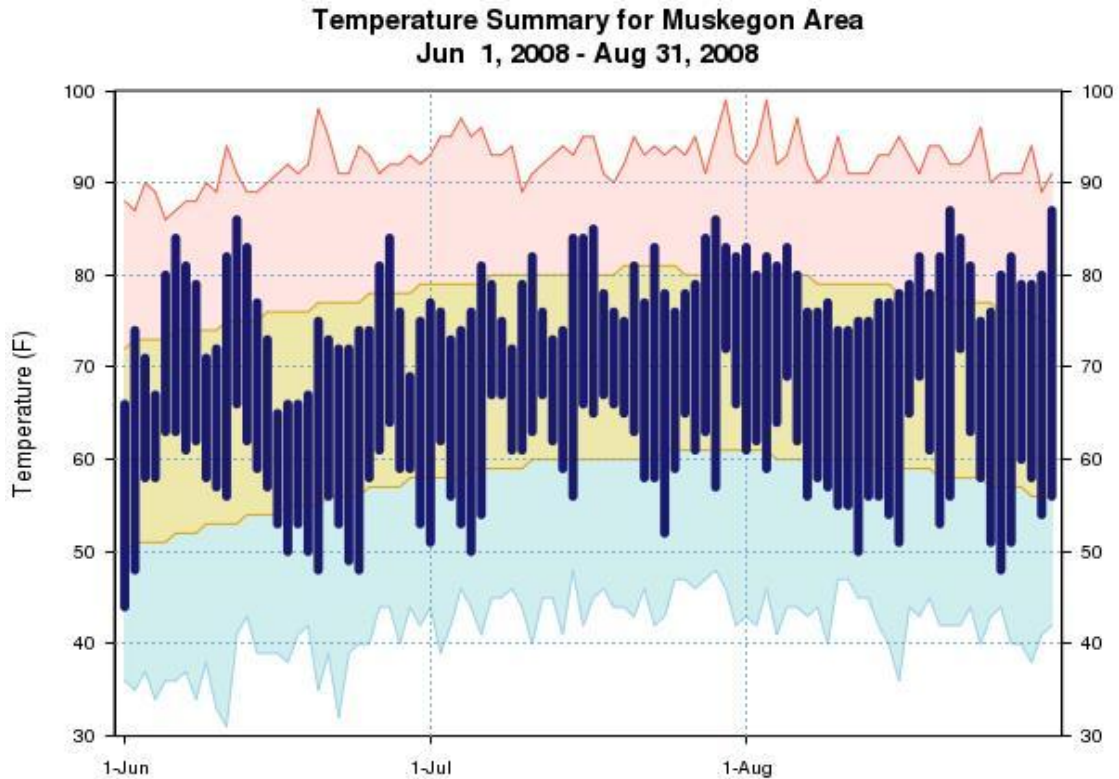


Fig. 5 As in Fig. 3 except for Muskegon

Precipitation Discussion:

The total precipitation for the summer of 2008 was greater than normal. Looking at Fig. 6, it is seen that the area average rainfall (based on 36 long term climate stations) for the summer of 2008 was one of the wetter summers for Southwest Lower Michigan over the entire period of record. There were only 20 summers wetter than this summer since uniform records began in 1895.

The areal distribution of the precipitation (Fig. 7) shows most of Southwest Lower Michigan had above normal precipitation. Figure 8 shows many areas getting more than 12 inches of rain, with between 15 and 20 inches of rainfall toward Mason County. During the past 3 summers the southwest lake shore areas were the driest. This summer Montcalm County was the driest part of Southwest Michigan; some locations in Montcalm County received less than 6 inches for the entire summer.

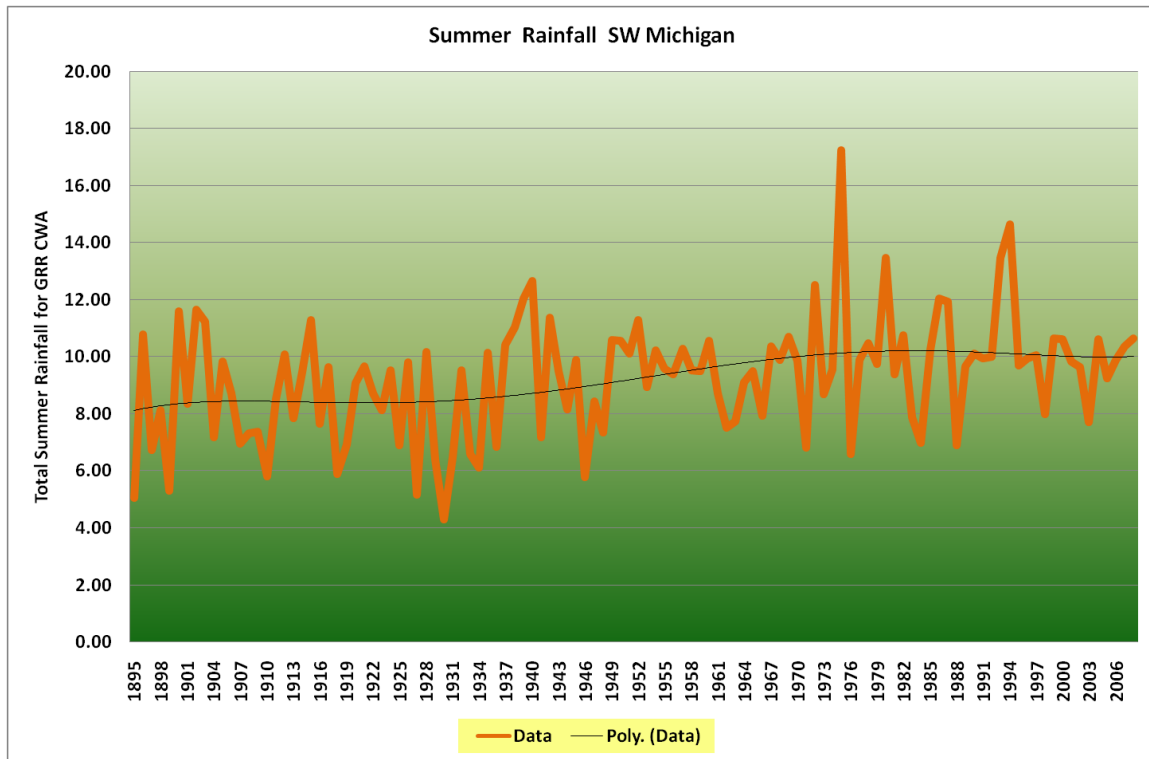


Fig. 6 The total Summer Rainfall since 1895 averaged among the 36 long term climate stations. The orange line is the total for each summer, while the black line is trend line. A polynomial was used for the trend line since it creates the smoothest curve through the data.

Figure 6 shows there is a trend toward wetter summers, which started in the 1940s then leveled off in the mid 1970s into the early 1980s. Since the early 1980s, there has been a slight decrease in the overall summer precipitation. However, mean area precipitation still remains nearly 2 inches wetter now than it was during the first 50 years of this data record (1885 through 1925).

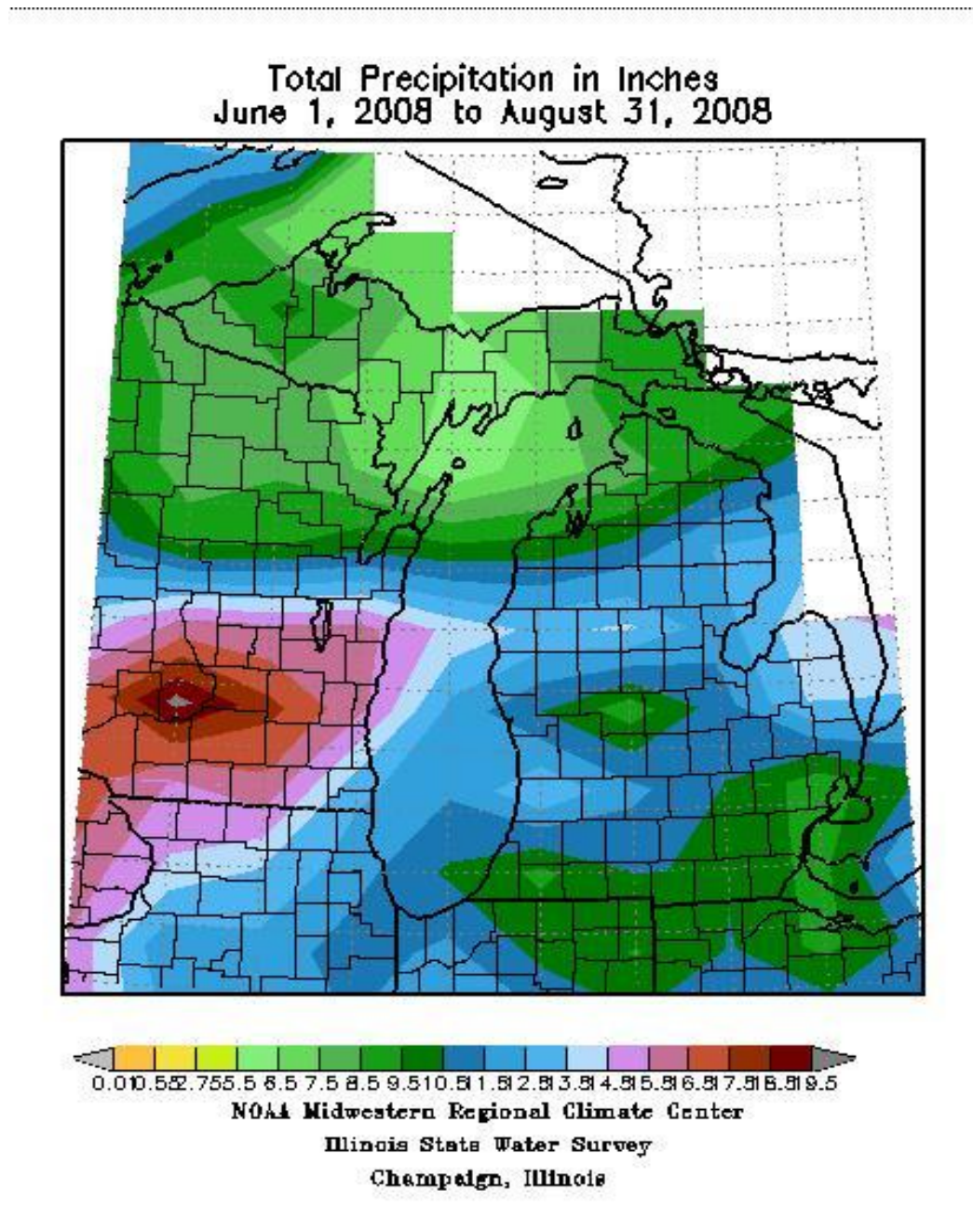
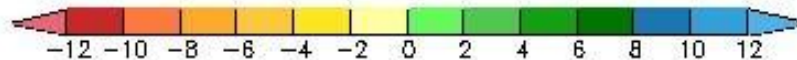
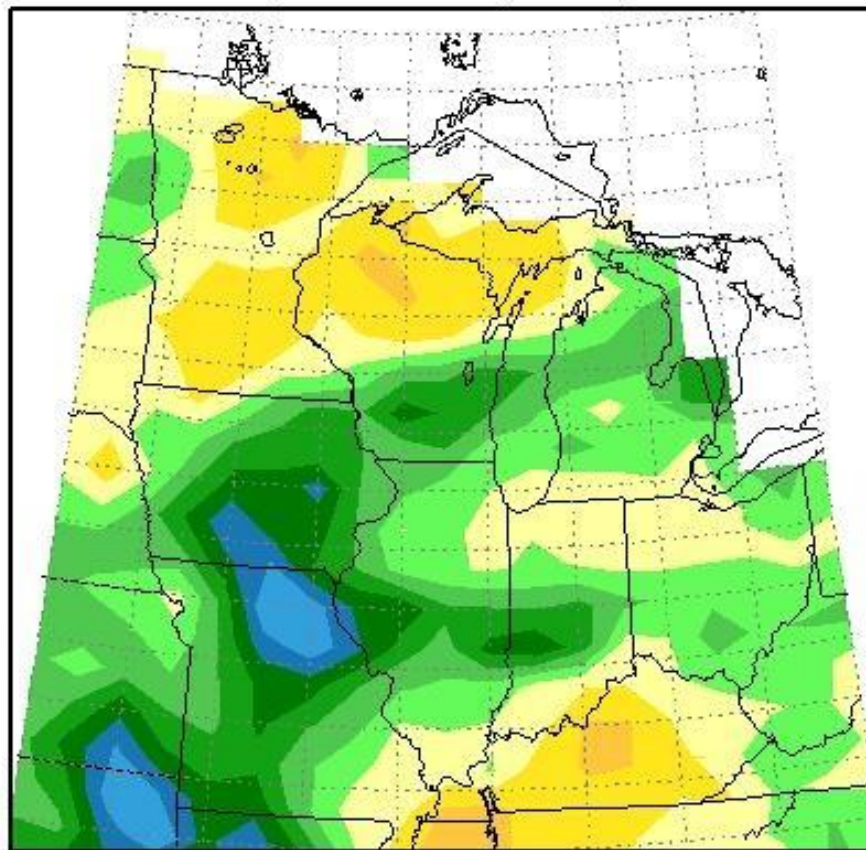


Fig. 7 Precipitation Totals for the summer of 2008

**Total Precipitation Departure from Mean in Inches
June 1, 2008 to August 31, 2008**



NOAA Midwestern Regional Climate Center
Illinois State Water Survey
Champaign, Illinois

Fig. 8 Departure from Normal of the total summer 2008 precipitation

The months of June and July were both very much wetter than normal across most of the area (Figs. 9 – 13). Curiously, during the middle of July, when it turned warmer than normal for three weeks (Fig. 3-5), it also dried out (Figs. 9 – 13). Precipitation from mid July through the end of August was well below normal across the area (Figs. 9 – 13).

Comparing Fig. 6 to Fig. 1, there appears to be a relationship between warm summers being dry and cool summers being wet. Looking at all summers since 1900, 60% of all warm summers were drier than normal while only 18% are wetter than normal (22% were near normal). Similarly, more than half the cool summers are wetter than normal. Accordingly, the last summer wetter than this summer was the cooler than

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normal summer of 2004. Out of all 114 summers on our record books, 2008 will go down as the 21st wettest.

Figures 9 through 12 shows the daily accumulation of precipitation compared to the normals. Also shown on these charts are the wettest and driest summers at various locations in the Grand Rapids County Warning area were used for these charts. All locations show the first two weeks of June as one of the wettest on record (blue line compared to green line). Also, it can be seen that at all locations, precipitation occurred frequently through June into early July. From mid July through August, very little precipitation fell. Even so, all but Lansing and Jackson shows that the summer's total precipitation was above normal. Note that Hasting (Fig. 12) is the wettest of the series and the 2008 accumulation is the all time record until the middle of August.

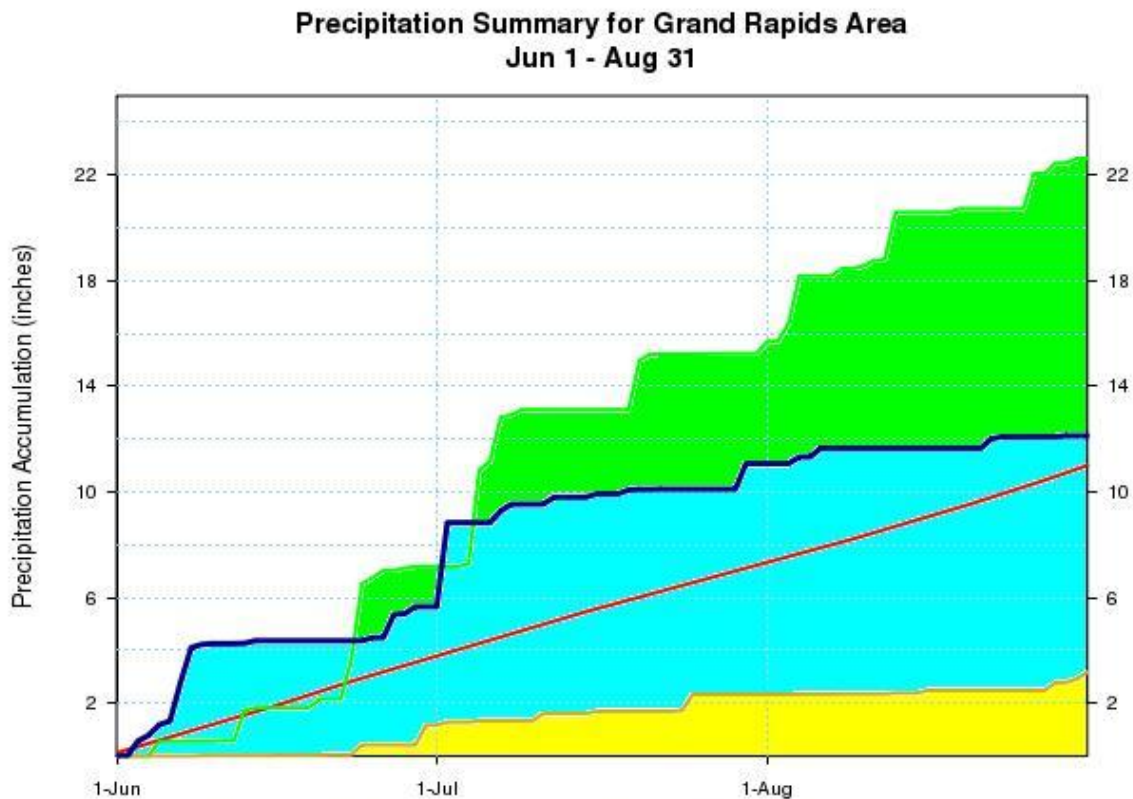


Fig. 9 The Grand Rapids Precipitation accumulation for the summer of 2008 is the heavy dark blue line. The smooth red line is the normal precipitation accumulation. The green line is the accumulation of precipitation for the wettest summer, 1994. The Tan line is the accumulation for the driest summer, 1918. The period of record is from 1892 to 2008.

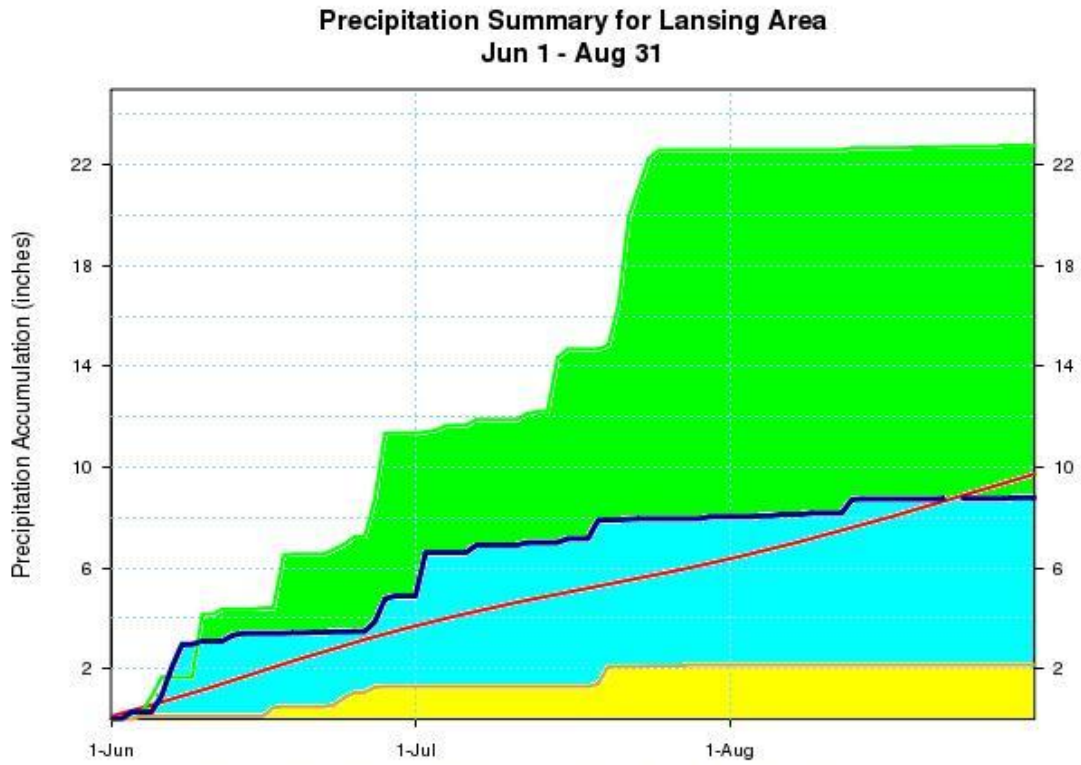


Fig. 10 As in Fig. 9 except for Lansing

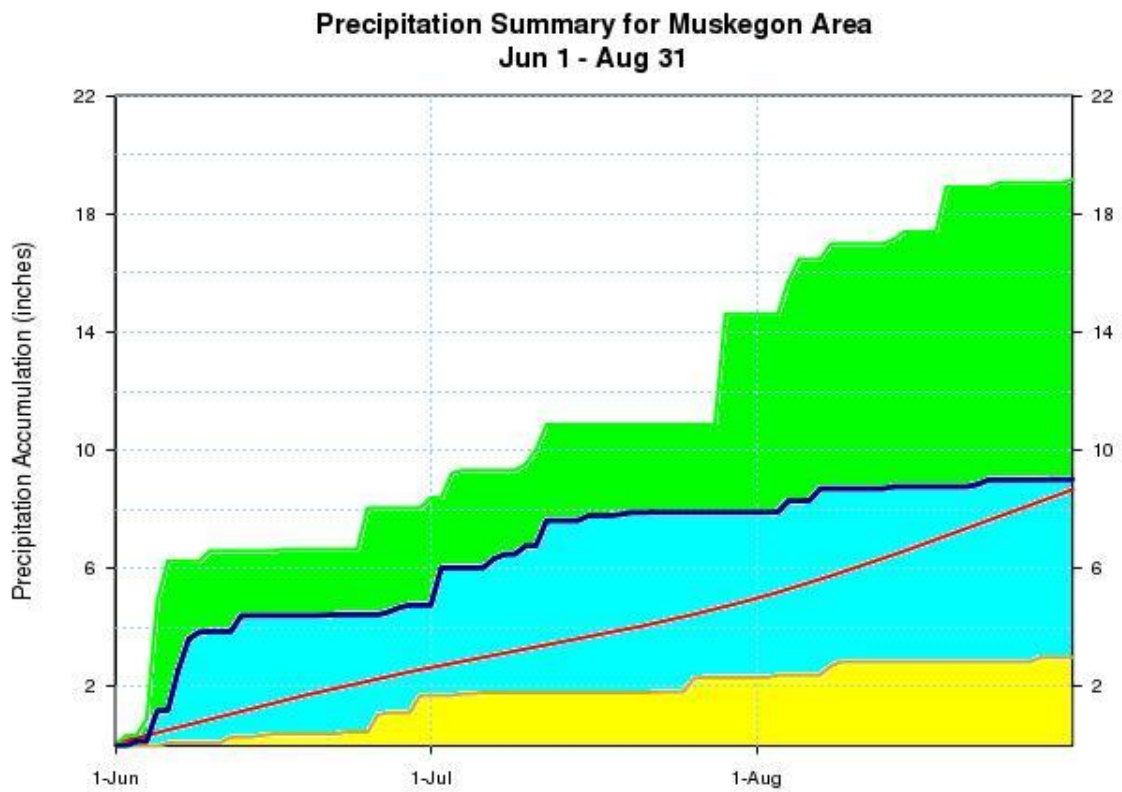


Fig. 11 As in Fig. 9 except for Muskegon

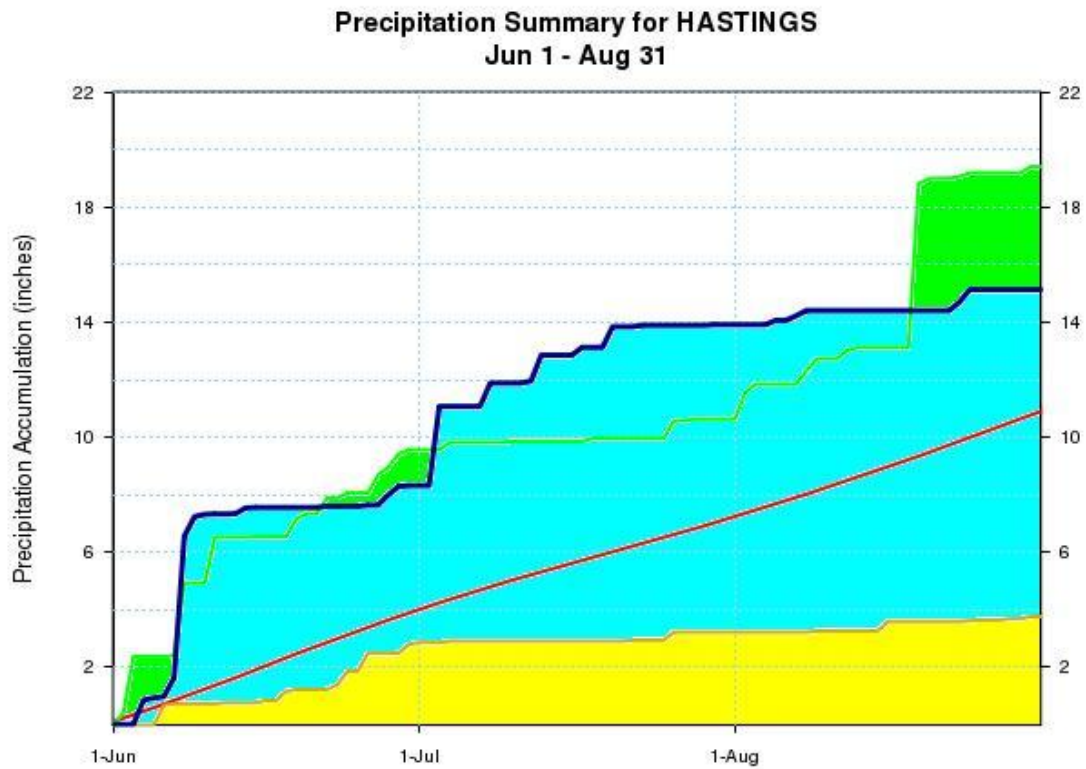


Fig. 12 As in Fig. 9 except for Hastings

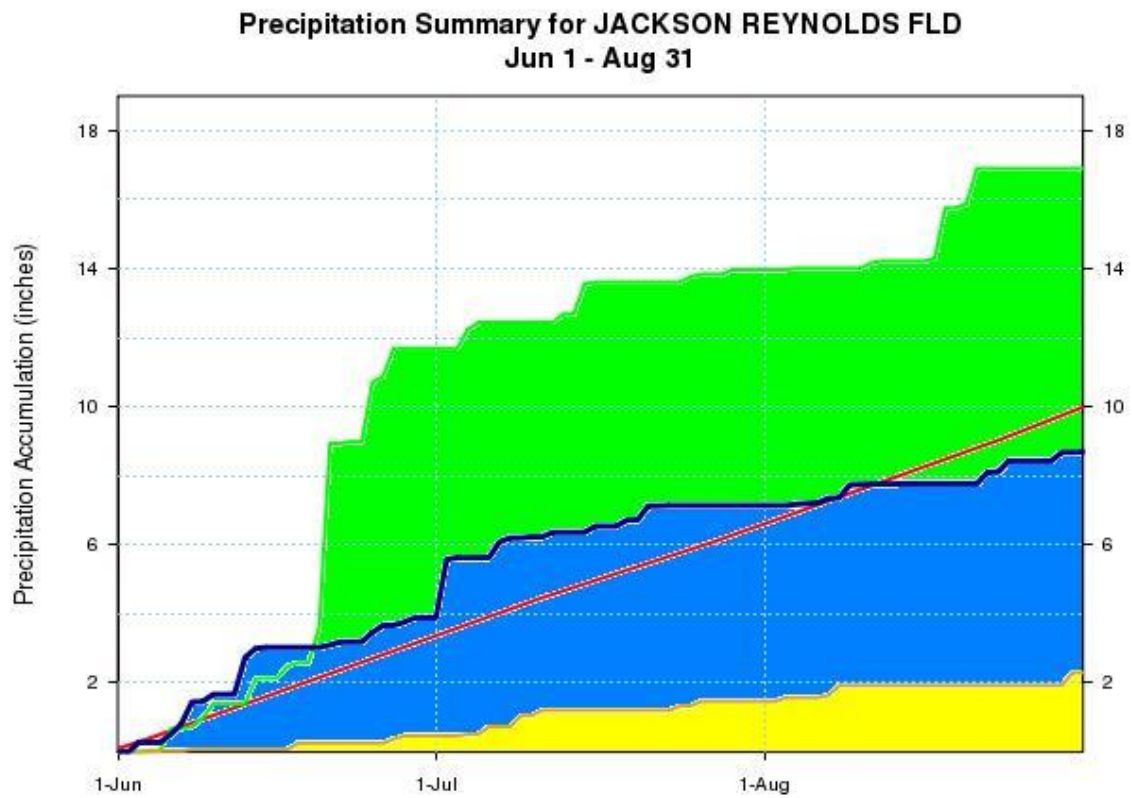


Fig. 13 As in Fig. 9 except for Jackson

Flooding and Severe Weather Discussion:

There were some memorable flood events during the summer of 2008. One of the best examples of that was the Mason and Osceola County flood of June 12th into the 13th. Many roads in those counties had significant washouts during that event. There were several lesser flood events in both June and July. The largest of those events occurred on June 7th, in Ottawa and Allegan Counties. There was the flood in the southwestern counties on the 2nd of July resulting from persistent thunderstorms over the same area in southwest and south central Lower Michigan. Finally there was the flood in southern Isabella County on July 16th. Prior to this, the last time a flash flood warning was issued from this office was in June of 2006!

Given that severe weather is typically associated with thunderstorm events, it should be no surprise that almost all of the severe weather for the summer of 2008, in southwest Lower Michigan, occurred during the wet months of June and July. There were four tornadoes reported in southwest Michigan, during the summer of 2008. Two tornadoes reported on June 8th (EF1), one on June 12th (EF1) and one on July 30th (EF0). The first tornado on June 8th hit around 2:20 PM in Osceola County, northeast of Hersey. Damage was mostly to barns and other farm buildings. The second tornado on June 8th touched down in Eaton County, northeast of Needmore, around 3:45 PM then headed east northeast into Ingham County, just west of Lansing before it dissipated. Damage was mostly to trees; however several homes had various amounts of damage to porches, roofs, and garages. Also damaged were several farm buildings. The June 12th event was also a weak tornado (EF1) that hit by the lake shore in Mason County in the late evening. Damage was mostly to trees and vegetation. On July 30th at 3:17 AM in the morning there was an EF0 tornado 3 miles north of Clare, in Clare County. Damage was limited to trees, one collapsed barn and a damaged carport.

The largest severe weather events in terms of the numbers of reports received during the event were on June 6th, June 8th and July 2nd. More than a four dozen damaging wind and hail reports were received during each of those events. The event on the 8th was the largest by far with over six dozen severe weather reports associated with it. Those events all occurred late afternoon and evening. The largest primarily hail event occurred during the late afternoon into the evening on June 15th. During the evenings of from June 26th through the 28th there were a series of wind damage events each day. On the evening of July 15th, there were nearly two dozen reports of large hail and wind damage. The final significant severe event was on July 30th, which resulted mostly in wind damage.

What caused this unusual weather?

Comparing the mean upper level pattern for this summer (Fig. 14) to the normal upper level pattern (Fig. 15) it can be seen that the upper level geopotential heights were unusually low over the western Great Lakes (Fig. 16). The more zonal (west to east) flow in 2008 kept the extreme heat and cold away from the Great Lakes. This idea is further

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shown by looking at the upper level wind speed zone from this summer (Fig 17) and comparing that to the normal pattern (Fig 18).

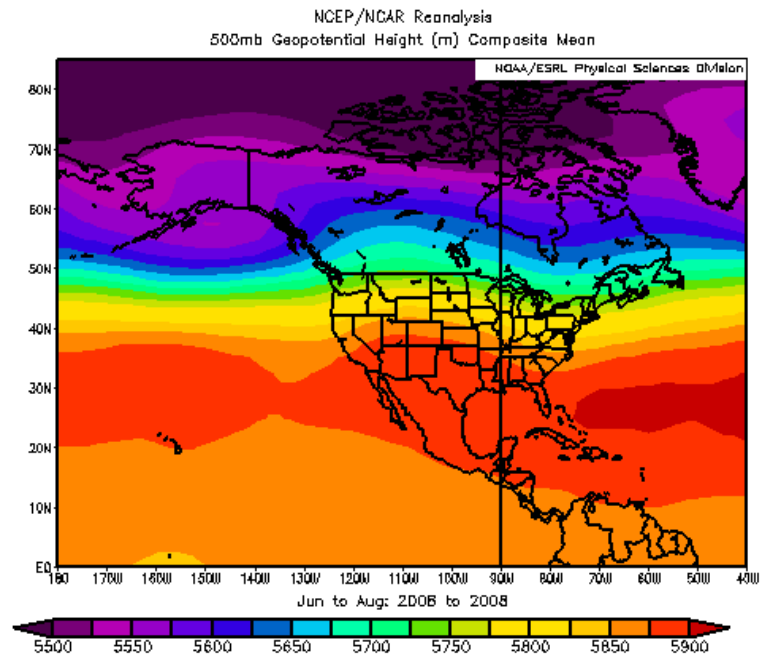


Fig. 14 The mean 500 mb geopotential heights for the summer of 2008

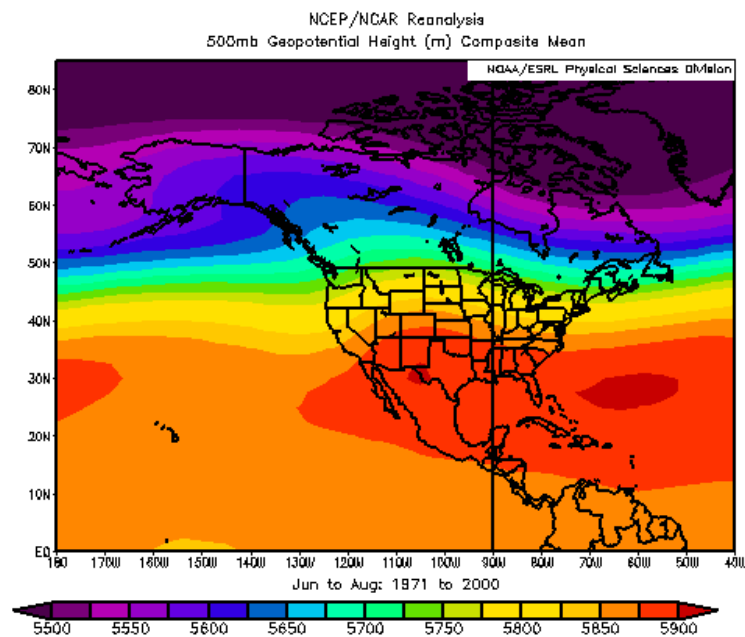


Fig. 15 The normal (1971-2000) 500 mb geopotential height pattern for the summer months.

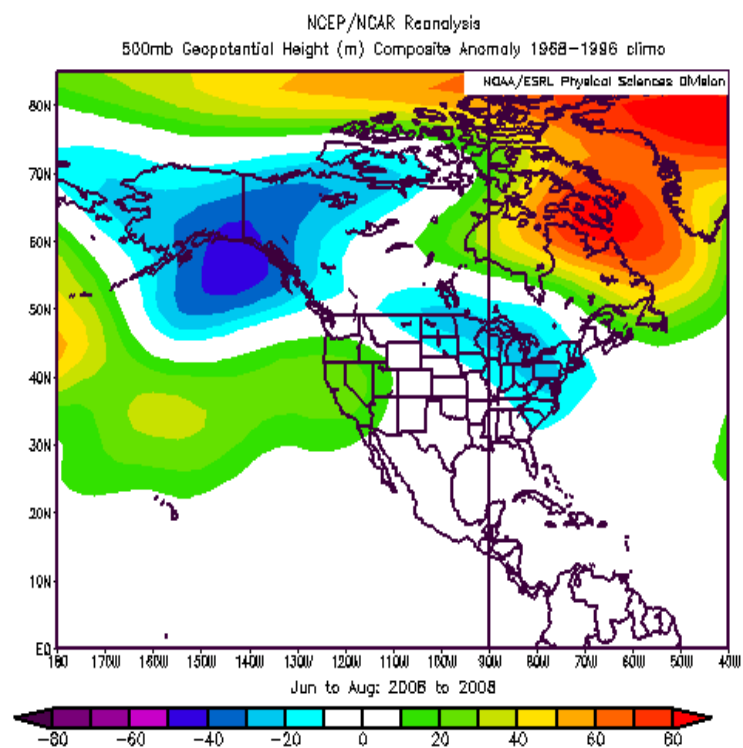


Fig. 16 The 500 mb geopotential height anomalies for this summer (2008).

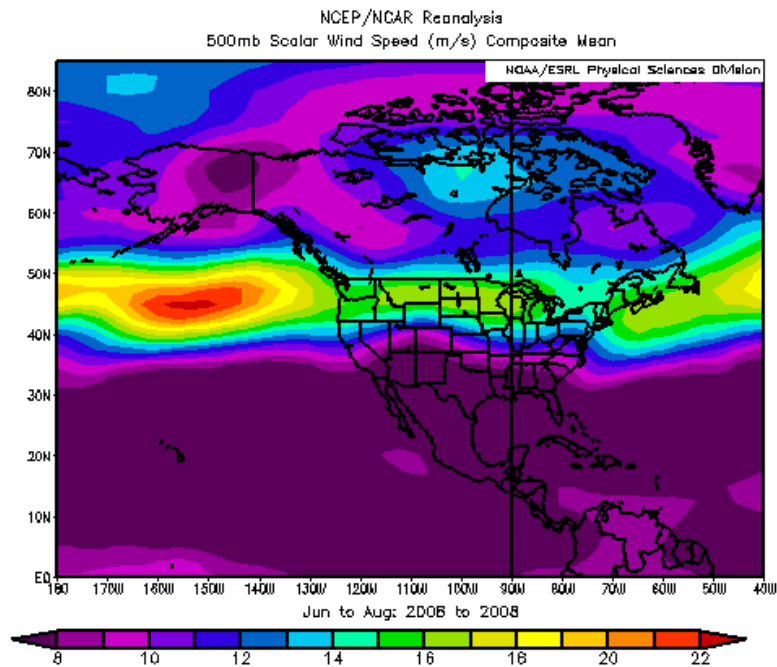


Fig. 17 The 500 mb wind speed from this summer (2008).

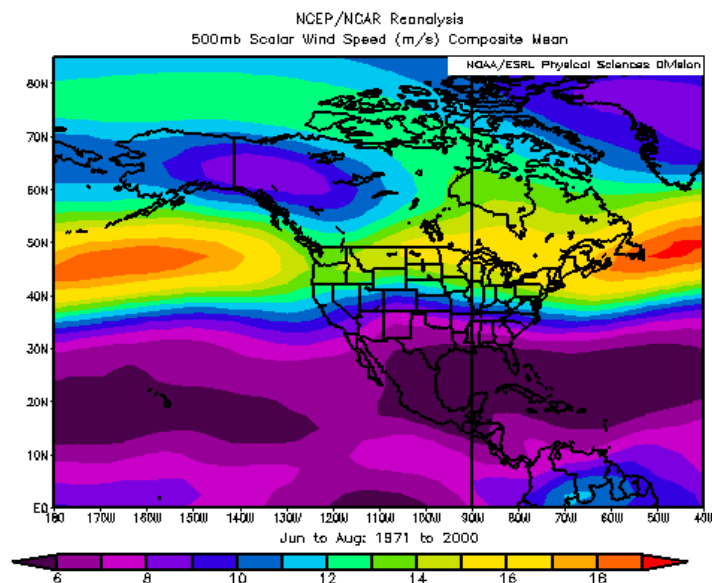


Fig. 18 The normal 500 mb summer wind speed pattern

The low level winds show why it was so wet during the first half of a summer, then why the second half of the summer was so dry. Figure 19 shows an anomalously

strong low level flow of air from the western Gulf of Mexico toward the Ohio Valley. This flow brought in unusually moist air, as seen by the unusually large precipitable water values observed during this time southwest of Lower Michigan (Fig. 20). It likely was so wet during the first half of the summer because this unusually strong and moist southwesterly flow interacted with the mean front (implied from the mean upper level jet position in Fig. 17). Once southerly low-level flow became more northeasterly in August (Fig. 21), very little precipitation occurred.

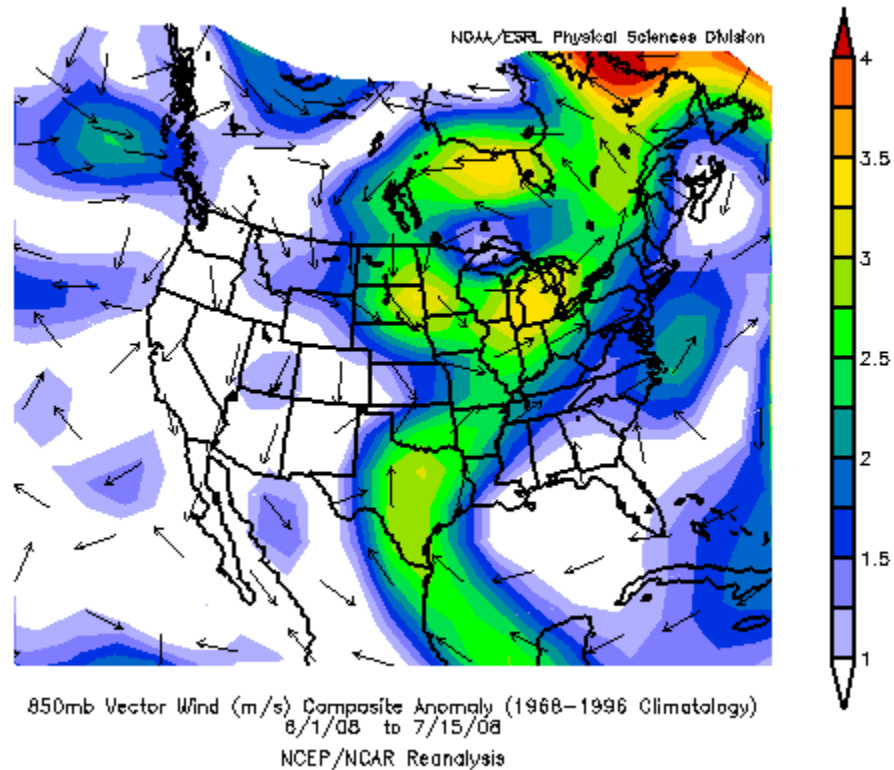


Fig. 19 850 mb vector wind anomaly for the first half of the summer of 2008 (June 1st – July 15th). Arrows indicate the difference from normal and the color curve indicates magnitude of difference in m/s.

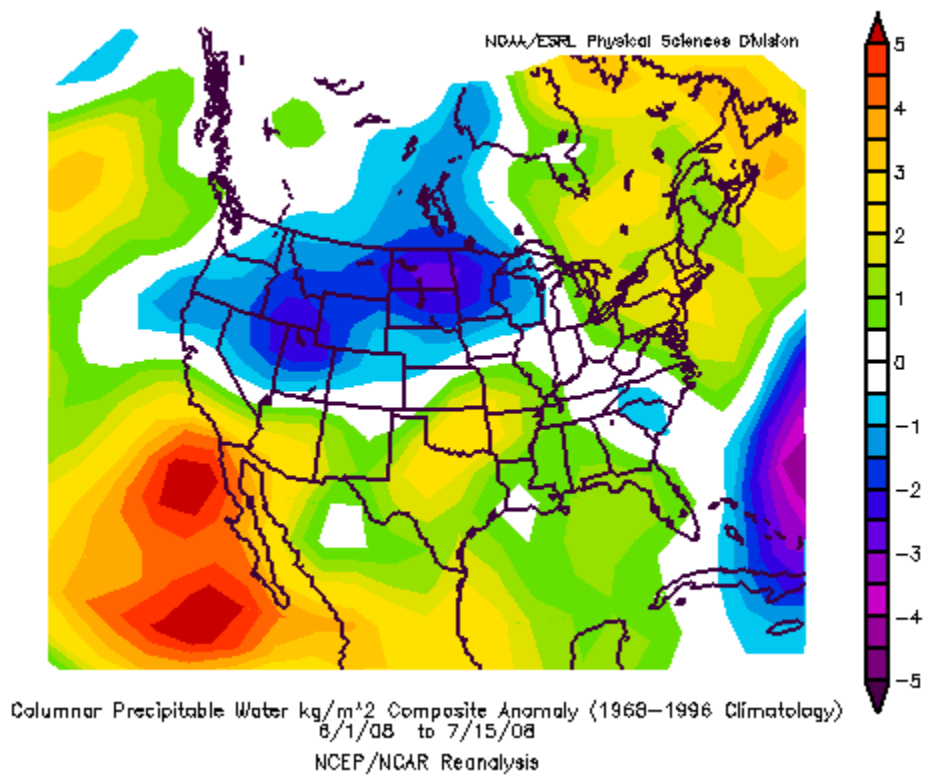


Fig. 200 Anomaly of precipitable water for the wet half of the summer of 2008 (June 1st – July 15th)

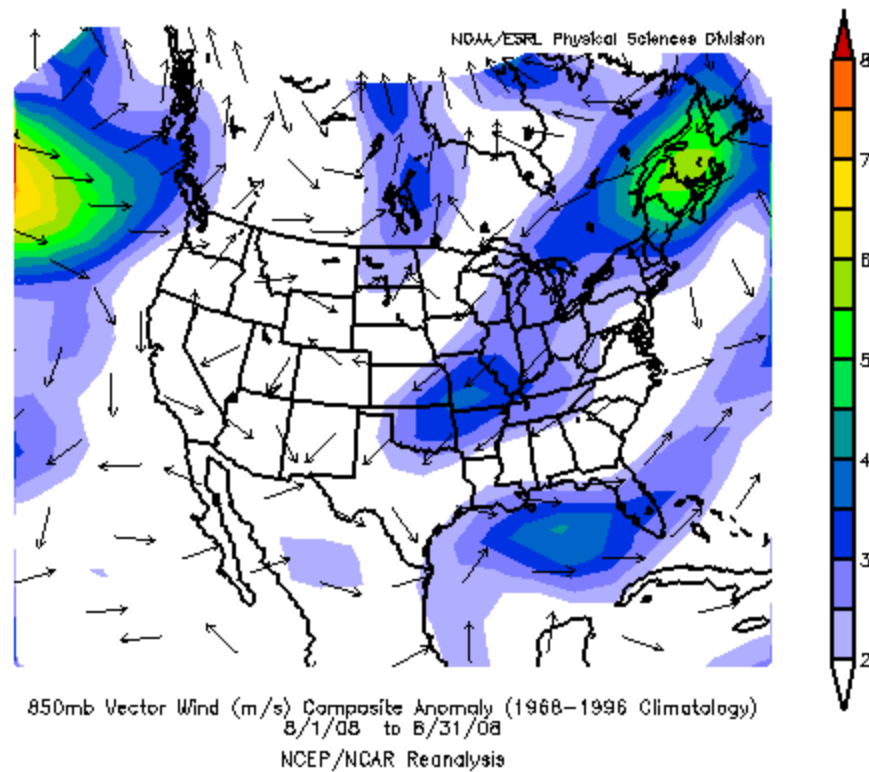


Fig. 211 As in Fig. 19, except for August of 2008.

Conclusion:

The summer of 2008 in Southwest Lower Michigan will be remembered as a relatively cool compared to the past 10 years. We have experienced only two cooler summers since 1999. It was wetter than normal, with most of the rain occurring early. Overall, the summer of 2008 will stand out as being rather different compared to other recent summers.